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ABSTRACT

The study examined the impact of varying student-teacher ratios on task completion and success, student instructional time, and quality of instruction in special education classes for mildly handicapped students. Subjects were 139 mainstreamed elementary students (grades 1-6), most of whom were categorically labeled as learning disabled (n=114). Students were observed during their special education time, within student-teacher ratios that varied from less than 1:1 (one student with two teachers) to over 15:1. Using grouped ratios represented by 1:1, 3:1, 6:1, 9:1, and 12:1, students' academic engaged time, task completion, and task success, as well as the qualitative nature of their instruction were compared. Targeted student behaviors were recorded by trained observers using rating scales and observational instruments. Data from structured interviews with students and teachers were also used. Significant differences were found in measures of both the quantitative and qualitative aspects of instruction, with nearly all favoring the lower student-teacher ratios. Lack of observed differences in task completion and task success rates (which were very high for all students in all student-teacher ratio groupings) was attributed to task content during special education instructional time. (Author/JW)

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University of Minnesota

RESEARCH REPORT NO. 12

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Martha L. Thurlow, James E. Ysseldyke,
and Joseph W. Wotruba

INSTRUCTIONAL ALTERNATIVES PROJECT

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Abstract

The purpose of this study was to examine the impact of varying student-teacher ratios on task completion and success, student instructional time, and quality of instruction in special education classes for mildly handicapped students. Subjects were 139 students (91 males and 48 females) in grades 1-6 receiving special education services. Students were from 8 school districts and were categorically labeled as: 114 learning disabled, 19 emotionally/behaviorally disturbed and 6 educable mentally retarded. Students were observed during their special education time, within student-teacher ratios that varied from less than 1:1 (one student with two teachers) to over 15:1. Using grouped ratios represented by 1:1, 3:1, 6:1, 9:1 and 12:1, students' academic engaged time, task completion, and task success, as well as the qualitative nature of their instruction, were compared. Significant differences were found in measures of botn the quantitative and qualitative aspects of instruction, with nearly all favoring the lower student-teacher ratios. Differences were not found in task completion and task success rates, but all were very high. Results are discussed in light of implications for special education.

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Student and Instructional Outcomes Under Varying Student-Teacher Ratios in Special Education

As increasing numbers of students are found to have mild handicaps and to be eligible for special education services, interest has increased in knowing more about the impact of varying student-teacher ratios on student academic performance and the nature of instruction in special education. Crucial to this issue are the significant financial difficulties encountered by school districts as the size of this population of students increases. A logical response to the pressure to increase services has been to vary student-teacher ratios (STRs), in some cases by eliminating statutory limits on STRs. It is criticial to examine the effects of different class sizes, particularly their impact on the education of students with mild handicaps.

In a recent analysis of state guidelines for student-teacher ratios nationwide for mildly handicapped students, we found tremendous variability in the guidelines and actual practices of districts (Thurlow, Ysseldyke, & Wotruba, 1987). In a national survey of special education teachers we found that the average STR for mildly handicapped children in special education settings, regardless of categorical classification, was 4.7:1, with a range of 1:1 to 15:1 (Ysseldyke, Thurlow, & Wotruba, 1987). These studies, however, did not provide information about the effects of different student-teacher ratios for students with mild handicaps.

There have been a number of studies on the effects of different class sizes or student-teacher ratios on student achievement (and other outcome variables) in general education classrooms (Robinson & Wittebals, 1986). Research on the effects of class size began in the early 1950s, and reached an apex in 1978-79 with Glass and Smith's (1979) meta-analysis. Still, class size effects have

continued to be a topic of interest and controversy in several reviews (cf. Albritton, 1984; Glass, Cahen, Smith, & Filby, 1982; South Carolina State Department of Education, 1980). Educators continue to debate the impact of varying STR on student achievement, for students without handicaps. Relatively litte attention has been given to the effects of varying student-teacher ratios in special education settings.

Most of the research that has been conducted related to class size in general education settings has focused on achievement. However, it is important to examine more than just changes in achievement. Other variables are as important. Included among these other factors are both quantity and quality of time (Ysseldyke, Thurlow, Christenson, & Weiss, 1987). Quantity of time refers to a measurement of time in days, hours, minutes, or seconds. A key variable nas been "academic engaged time," which has variously been called "academic learning time," "opportunity to learn," "academic responding time," and "time on task." This type of time refers to the amount of time that students spend actually engaged in learning or academic responding, such as reading silently, reading aloud, answering questions, asking questions, writing, etc. The amount of time during which students are moving from one area of a room to another, or looking out the window, or sharpening their pencils, or waiting for the teacher to work with them, is <u>not</u> considered to be academic engaged time.

For several years, research on academic engaged time focused only on general education students. Recently, however, research began to address the academic engaged time of handicapped students. For example, Thurlow, Graden, Greener, and Ysseldyke (1983) found that mildly handicapped students were engaged in making active academic responses for only about 45 minutes of a 6½

hour school day. Others have looked at more severely handicapped learners (e.g., Zigmond, Vallecorsa, & Leinhardt, 1980), and at different categories of handicapped students (e.g., Hall, Delquadri, Greenwood, & Thurstone, 1982), and have obtained essentially the same findings.

Another important trend has been a focus on qualitative aspects of instruction. As Good (1983) noted, "the value of future classroom research will improve if more attention is placed upon the quality of instruction" (p. 129). While many efforts are being made in this direction, the focus for the most part is on general education instruction.

The purpose of this study was to examine the impact of varying STR on student task completion and success and student instructional time, while observing and documenting quality of instruction in special education classes for students with mild handicaps. In contrast to studies in general education, wnere STRs almost always are above 15:1, the focus of this study was on STRs of less than 15:1, ratios that reflect current practice in special education classrooms (see Ysseldyke, Thurlow, & Wotruba, 1987). Specific questions of interest in this study were:

- How much time is allocated to academics and what kinds of tasks and grouping structures are used under different STRs?
- What percentage of special education time is the student academically engaged under different STRs?
- What percentage of special education time is the student making active academic responses under different STRs?
- What percentage of special education time is the student involved in management responses under different STRs?
- What percentage of special education time is the student behaving inappropriately under different STRs?
- To what extent do students' task completion and task success vary with STR?

- To what extent does the qualitative nature of instruction differ under different STRs?

Method

Subjects

Subjects were 139 students in grades 1-6 who were receiving special education services for students with mild handicaps. Included were 91 males and 48 females who were categorized as learning disabled (LD; N = 114), emotionally/behaviorally disturbed (EBD; n = 19), or educable mentally retarded (EMR; n = 6). They were from 27 schools in eight school districts. Descriptive data for the 139 students as a function of primary student-teacher ratio are presented in Table 1.

In addition to parent permission, a single criterion had to be met for a student to be included as a subject in this study. The student had to be an elementary school pupil who was receiving services in level 3 or level 4, which meant that the student spent time in both regular education and special education (students in level 3 received special education services for less than half of a school day; students in level 4 received special education services for more than half of a school day).

Instruments

CISSAR. A modified version of the CISSAR (Code for Instructional Structure and Student Academic Response) observation system was used in this study. The CISSAR system was developed by the Juniper Gardens Children's Project in Kansas City, Kansas (Greenwood, Delquadri, & Hall, 1978), to provide information on quantity of time spent and behavior of one target student. In the original system, 19 student response codes were defined. These were combined to form

Table 1

Descriptive Information on Subjects in Each Student-Teacher Ratio

	Ratio				
	1:1	3:1	6:1	9:1	12:1
Total Number	17	59	49	7	7
School District					
1	4	9	-	-	-
2	2	14	8	-	-
3	7	6	10	2	1
4	4	15	9	-	2
5	-	5	12	2	-
6	-	6	6	1	2
7	-	4	3	-	-
8	-	-	1	2	2
Student Category					
LD	15	50	40	4	5
EBD	2	7	6	2	2
EMR	-	2	3	1	-
Student Gender					
Male	9	35	35	7	5
Female	8	24	14	-	2
Student Grade					
1	-	1	-	-	-
2	2	15	5	-	-
3	5	19	11	1	1
4	4	7	7	3	2
5	6	13	19	3	2
6	-	4	7	-	2

Note: Entries are numbers of students.

three composite variables: active academic responses, task management responses, and inappropriate responses. One of the inappropriate responses (self-stimulation) was deleted and another task management response (waiting) was added. "Waiting" was defined as time when the student is not involved in any response and the situation involves an obvious "wait" time such as when the student is in line, teacher stops lecture to answer telephone, etc. (see Stanley & Greenwood for definitions of other student response codes). The decision to make these modifications was based on previous observational studies which found minimal self-stimulation behavior, but a great deal of waiting time.

A momentary time sampling technique was used by trained observers to direct the recording of events. The targeted student behaviors were recorded using portable computers (NEC and IBM PC convertible), programmed to enter data using a momentary timed sampling technique by trained observers at 10 second intervals. After the observer entered information about the target student, the number of students in the class, and the number of adults, the observer entered information about the content area, the task the student was engaged in, and the structure in which instruction was received (entire group, small group, individual). This type of programmed "ecological" screen was repeatedly displayed every 70 seconds, and during the 60 seconds between the ecological screens, the computer displayed the student response codes every 10 seconds. Appendix A includes the activity codes, task codes, physical structure codes, student response codes, and instructional structure codes programmed into the IBM modified version of CISSAR.

Task Completion/Task Success Form

A form was developed on which to record, for each task, the number of items possible, the number of items attempted, and the number of items correct. The content area and type of task were listed along one side, followed by the appropriate numbers. For any one subject, the number of tasks could vary from none to more than five, and might include tasks for several content areas or only one. For analysis purposes, task completion (number attempted divided by number possible) and task success (number correct divided by number attempted) were calculated across all tasks recorded for a subject.

IES

Tne IES consists of 40 descriptive statements about an individual student's instruction. After an observation and interview of the targeted student, the observer rated the extent to which each statement was characteristic of the instruction the target student received.

Tne IES is an ordinal scale, using 4, 3, 2, or 1 categorical ratings to indicate how characteristic of an individual student's instruction the qualitative statement was (i.e., 4 = "very much like the student's instruction"; 3 = "like the student's instruction"; 2 = "somewhat like the student's instruction"; 1 = "not at all like the student's instruction"). These categorical ratings were considered to be mutually exclusive, and forced the data collector to make a decision rather than choose the midpoint.

The 40 IES items are organized into 6 logical clusters: Instructional Presentation, Instructional Planning, Checking for Student Understanding, Task Relevance, Practice, and Feedback (see Ysseldyke, Christenson, McVicar, Bakewell, & Thurlow, 1986). These clusters were used to summarize the IES data.

TIES

TIES (Ysseldyke & Christenson, 1987) is an observational instrument used to assess the ecological environment of the instructional setting. Two major purposes for using TIES are: (a) to systematically describe the extent to which a student's academic or behavior problems are a function of factors in the instructional environment, and (b) to identify starting points in designing appropriate instructional interventions for individual students.

TIES is designed to gather information on 12 domains of effective instruction supported by the literature. They are: Instructional Presentation, Classroom Environment, Teacher Expectations, Cognitive Emphasis, Motivational Strategies, Relevant Practice, Academic Engaged Time, Informed Feedback, Adaptive Instruction, Progress Evaluation, Instructional Planning, and Student Understanding. It is a paper/pencil instrument used by a trained observer, with ratings on a four-point scale like that used in the IES.

Procedure

Observer training. Training of CISSAR and IES/TIES observers was conducted separately. Each group received two weeks of formal training sessions conducted by project staff members.

For CISSAR observers, training focused on learning and practicing code definitions and use of the portable computer to enter codes; this was followed by 2-3 days of classroom practice. Training was based on the CISSAR Observer and Trainer's Manual (Stanley & Greenwood, 1980), which was modified to reflect changes in the observation codes and use of the computers rather than paper and pencil coding. Inter-observer agreement was monitored throughout the training period, and checks were conducted six separate times during the data collection

period. Checks occurred at different times during the school day, in different classrooms, and in different content areas. At the time that data were collected for this study, the observers were very experienced in using the observation system. Over the course of three years using the system, the average inter-observer agreement was 95%. During the current study, using the portable computers to enter data, average inter-observer agreement was 95% (Activity - 99%; Task - 94%; Physical Structure - 98%; Instructional Structure - 96%; Student Response - 88%).

For IES/TIES observers, training focused on the use of the observation and interview system, accomplished with the aid of the relevant training manuals. Training required observers to read materials, to learn definitions for each item, and to integrate multiple sources of information. Discussion of rating considerations and practice rating items through the use of written examples, videotapes, and classroom practice was used extensively. Because both instruments required global, integrative judgments, training involved much discussion and viewing of videotapes.

Training was shared by two project staff members. Two weeks of half day training sessions were required to cover material presented in the manual. This was followed by two to three days of additional practice coding within the actual classrooms.

Inter-rater agreement was checked by comparing the ratings of pairs of observers; this was done for 33 pairings during the study. Either two or three observers were in the same classroom for a one hour observation during reading or math. For 13 of the pairings, one observer conducted the teacher interview while the other(s) listened. For 20 of the pairings, only a student interview

was conducted. Inter-rater agreement was calculated in two ways: grouped and exact. Grouped inter-rater agreement was calculated by combining ratings of "1" and "2" and by combining ratings of "3" and "4". Exact agreement did not involve combining ratings. Since IES and TIES were qualitative rating scales, requiring the data collector to make global, integrative judgments about a complex area, the minimum desired inter-rater agreement was 50% on exact items and 75% on grouped items. The average agreement on exact for IES was 52.8% (range = 35% to 70%) and on grouped was 80.6% (range = 59% to 93%). The average agreement on exact for TIES was 47.8% (range = 15% to 67%) and on grouped was 76.2% (range = 36% to 100%).

Data collection. Observations were conducted during each student's special education time. For some students, scheduled special education time was 30 minutes, for others 45 minutes, and for others 60 minutes. The CISSAR observer and the IES/TIES observer observed the target student at the same time. When tne observation period was over, the IES/TIES observer interviewed the student; the CISSAR observer recorded information about task completion and task success. The IES observer interviewed the teacher at a pre-scheduled time, usually at the end of the day.

Data Analysis

For data analysis, naturally-occurring student-teacher ratios were grouped into five categories and given labels as follows: 1:1 = ratios of one student to one teacher, or less (as in one student with two teachers, a situation that did occur); 3:1 = ratios of three students or fewer to one teacher, but more tnan one student to one teacher; 6:1 = ratios of six students or fewer to one teacher, but more tnan three students to one teacher; 9:1 = ratios of nine or

fewer students to one teacher, but more than six students to one teacher; 12:1 = ratios of more than nine students to one teacher. Naturally-occurring ratios ranged from 0.5:1 to 19:1. Comparisons among the grouped ratios were conducted using both independent group analysis and within-subjects analysis.

In order to apply statistical procedures for comparing independent groups, the data for some subjects had to be dropped. This occurred when a subject was observed in more than one student-teacher ratio category. Thus, if a student was observed in 4:1 and 6:1 ratios, all data were included because the observations were in the same ratio category (i.e., 6:1); if a student was observed in 2:1 and 6:1 ratios, only those data from one of the two were included. This situation occurred 44 times for the 139 students who were observed. The decision rules for which set of data to drop for this analysis were: (a) drop any set of data for which the total time observed was less than 5 minutes (this occurred 14 times), and (b) if more than one data set remains (e.g., data for 1:1 and 6:1 ratios), keep the one with the greatest number of minutes of observation time and drop the other(s) (this occurred 30 times). A summary of the amounts of time dropped from the independent group analysis is provided in Table 2. Also included is the average number of minutes on which independent group analysis was completed. Because of the wide range of actual observation times (see Table 2), times were transformed to percentages before analyses were conducted.

It should be noted that data were dropped in this way only for the independent group analysis. The second analysis, in which observational data across ratios were compared within students, used all available data for those students in more than one ratio, except data based on less than five minutes of observation time.

Table 2

Summary of Data Dropped and Observation Times for Retained Data in Independent Group Analysis

	Ratio				
	1:1	3:1	6:1	9:1	12:1
Original Number of Observations	29	75	61	11	7
Minutes Dropped - Total < 5 mins					
M	2.97	3.61	2.89	2.28	-
SD	1.27	1.40	1.42	1.51	-
N	5	3	3	3	0
Minutes Dropped - Fewer mins than another ratio					
M	10.28	12.69	14.11	11.33	-
SD	4.96	6.56	5.16	-	-
N	7	13	9	1	0
Observed Time in Analysis					
M	24.62	28.92	33.60	33.90	24.62
SD	13.09	11.56	12.06	10.87	7.67
Range	11-59	11-57	8-60	24-56	14-36
N	17	59	49	7	7

Results

Instructional Time

Independent group analyses. One-way ANOVAs were conducted to compare percentages of time devoted to selected activities, tasks, grouping structures, instructional structures, and student responses. Because of the large number of codes for which no time was observed (e.g., in special education, the activities of science, and arts and crafts never occurred), a decision rule was applied to select variables to include in the analysis. The decision rule was that only those variables for which less than 80 cases had no data were included (i.e., variables that nad more than 80 subjects without data were not analyzed). Thus, 25 of 48 possible comparisons were conducted, in addition to those for the composite variables (academic activity, nonacademic activity, paper tasks, teacher tasks, academic engaged time, active responding time, task management time, and inappropriate response time). A list of the variables included in the analyses and the definitions of the composite variables are included in Table 3.

For percentages of time allocated to selected activities, tasks, and structures, 14 one-way ANOVAs were run. Findings of significant differences were found for three of the variables (teacher-student discussion, entire group, individual) and for one composite (teacher tasks). The means and standard deviations for these variables and the variables for which differences were nonsignificant are shown in Table 4. Follow-up tests using the Tukey-HSD procedure indicated that students spent a greater proportion of time involved in teacher-student discussions in the 12:1 ratio (26%) than in the 3:1 ratio (8%). Follow-up tests also indicated that 3:1, 6:1, 9:1, and 12:1 STRs had larger percentages of time allocated to entire group structures (49% - 72%) than the

Table 3

Variables and Composites Included in Independent Group Analyses

Code Area	Variable	Composite (and Definition)
Activity	Reading Transition	Academic = Reading + Math + Spelling + Handwriting + Language + Science + Social Studies + Computer Training Nonacademic = Arts & Crafts + Freetime + Business Management + Transition
Task	Textbooks Worksheet Paper & Pencil Other Media Teacher-Student Discussion Fetch-Put Away	Paper Tasks = Workbook + Worksheet + Paper & Pencil Teacher Tasks = Listen to Lecture + Teacher-Student Discussion
Grouping Structure	Entire Group Individual	
Instructional Structure	Instruction to Entire group Instruction to Small group	
Student Response	Writing Reading Aloud Reading Silently Talk Appropriately Answer Question Ask Question Attend Passively Look for Materials Move to New Location Play Appropriately Talk Nonappropriately Look Around Wait	Active Responding Time (ART) = Writing + Play Game + Read Aloud + Read Silently + Talk Appropriately + Answer Question + Ask Question Academic Engaged Time (AET) = ART + Attend Passively Task Management = Raise Hand + Look for Materials + Move to New Location + Play Appropriately + Wait Inappropriate Behavior = Disruption + Play Inappropriately + Inappropriate Task + Talk Nonappropriately + Inappropriate Locale + Look Around

Table 4

Percentages of Special Education Time Allocated to Selected Activities, Tasks, and Structures

		Ratio						
		1:1	3:1	6:1	9:1	12:1	F-Ratio	F-Prob[a]
Reading	M	63.47	53.49	54.03	38.09	38.12	.742	ns
	SD	40.16	39.98	40.82	47.91	48.81		
Transition	M	1.44	2.45	2.21	1.21	--	1.110	ns
	SD	2.80	3.93	3.27	1.48	--		
Readers/ Textbooks	M	16.91	17.99	17.51	20.54	11.42	.153	ns
	SD	21.63	26.01	21.83	24.09	19.51		
Academic[b]	M	95.50	94.12	92.75	96.14	98.98	1.0219	ns
	SD	7.40	7.18	11.63	3.26	1.79		
Nonacademic[b]	M	4.50	5.88	7.25	3.86	1.02	1.0219	ns
	SD	7.40	7.18	11.63	3.26	1.79		
Worksheets	M	24.41	29.02	22.34	25.01	26.38	.400	ns
	SD	26.24	29.29	26.10	35.43	21.36		
Paper/Pencil	M	20.10	11.17	15.96	1.99	10.88	1.684	ns
	SD	21.71	16.06	21.24	5.27	18.63		
Other Media	M	12.13	15.03	14.35	22.11	9.10	.394	ns
	SD	23.38	19.54	21.79	34.06	11.62		
Teacher-Student Discussion	M	14.70	8.39	14.75	18.46	26.56	2.854	.026
	SD	18.14	11.09	16.63	27.18	27.32		
Fetch/Put Away	M	1.46	3.88	2.67	3.83	1.90	1.575	ns
	SD	2.68	5.03	3.14	4.51	2.56		
Paper Tasks[b]	M	54.19	53.64	47.16	30.81	43.38	1.223	ns
	SD	31.35	29.61	28.68	39.23	25.14		
Teacher Tasks[b]	M	15.31	9.47	18.32	22.71	34.20	3.998	.004
	SD	20.14	12.87	18.45	28.63	35.00		
Entire Group	M	2.96	49.12	72.29	57.86	71.06	11.605	.000
	SD	11.79	40.69	37.37	41.51	39.73		
Individual	M	96.72	30.65	4.79	13.41	6.11	41.264	.000
	SD	11.78	36.18	12.96	22.62	16.17		
Instr. to Entire Group	M	66.67	74.79	71.82	68.35	82.07	.151	ns
	SD	57.74	40.73	42.22	46.97	36.39		
Instr. to Small Group	M	33.33	25.21	28.18	31.65	17.93	.151	ns
	SD	57.74	40.73	42.22	46.97	36.39		

[a]F-ratios and probability levels are based on df = 4,134.
[b]Composite variables that include several coded variables (see Table 3).

1:1 STR (3%), and smaller percentages of time allocated to individual structures (4% - 30% versus 97%). (In fact, the finding of 3% in entire group in the 1:1 STR probably reflects a coding error.) In addition, significantly greater percentages of time in individual structures and significantly smaller percentages of time in entire groups were noted for 3:1 versus 6:1. The follow-up test for the teacher tasks composite indicated that a greater percentage of time in these tasks occurred in 12:1 ratios (34%) compared to 3:1 ratios (9.5%).

For time in various student responses, 17 one-way ANOVAs were run. Significant differences were found for seven of the student response variables (writing, reading aloud, talking appropriately, answering questions, asking questions, attending and looking around) and for all four composite variables (academic responding time, academic engaged time, task management, and inappropriate behavior). The means and standard deviations for these variables and the variables for which differences were nonsignificant are presented in Table 5.

Follow-up tests using the Tukey-HSD procedure did not show significant differences between any individual pairs of ratios for writing. The trend was toward larger percentages of time writing in STRs of 1:1 (20%), 3:1 (15%), and 6:1 (12%) compared to STRs of 9:1 (8%), and 12:1 (7%). Percentage of time reading aloud was found to be significantly different for the 1:1 ratio (14%) compared to both the 6:1 (6%) and the 12:1 (2%) ratios. Proportion of time in appropriate talk was found to be significantly greater in the 1:1 ratio (8%) compared to all other ratios (3% - 4%). A greater percentage of time in answering questions was found in STRs of 1:1 (11%) and 3:1 (8%) compared to only the 6:1 STR group (4%). Significant differences between pairs of ratios were not

Table 5

Percentages of Special Education Time in Various Student Responses

		Ratio						
		1:1	3:1	6:1	9:1	12:1	F-Ratio	F-Prob[a]
Writing	M	20.41	15.43	12.58	7.62	7.29	3.120	.015
	SD	10.36	11.44	10.50	10.87	9.00		
Read Aloud	M	14.54	9.55	5.63	7.85	2.09	4.351	.002
	SD	12.08	9.62	6.93	9.51	2.57		
Read Silently	M	8.41	12.14	12.39	10.61	10.89	.579	ns
	SD	8.87	10.41	10.18	7.58	9.39		
Talk Appropriate	M	8.23	3.53	4.24	3.04	2.64	5.186	.001
	SD	7.38	3.03	3.66	2.17	2.48		
Answer Questions	M	10.88	8.13	4.51	4.91	3.51	4.805	.001
	SD	7.12	7.92	3.49	4.67	2.31		
Ask Questions	M	.80	1.85	1.17	.51	.40	2.992	.021
	SD	.95	2.13	1.35	.45	.41		
Attending	M	28.00	29.00	38.16	44.57	52.85	8.635	.000
	SD	15.55	12.73	11.39	22.53	15.96		
Look for Materials	M	.94	1.98	2.01	3.80	1.21	1.681	ns
	SD	1.40	2.46	2.36	6.19	1.78		
Moving to New Station	M	.86	1.78	1.54	1.34	1.72	1.360	ns
	SD	.87	1.77	1.31	1.16	.97		
Play Appropriately	M	.54	1.53	2.80	5.52	.17	1.681	ns
	SD	.98	3.48	6.64	12.68	.30		
Talking Non-Appropriately	M	.79	1.27	.88	1.63	3.09	1.257	ns
	SD	2.34	2.98	1.02	3.07	6.73		
Looking Around	M	1.12	3.81	4.54	2.53	6.70	3.777	.006
	SD	1.75	3.94	3.90	2.02	6.33		
Waiting	M	.18	2.76	2.26	3.13	1.28	2.009	ns
	SD	.43	4.15	3.52	2.97	1.47		
Academic Responding Time[b]	M	66.64	55.21	44.38	35.33	27.65	13.087	.000
	SD	15.21	16.35	14.46	22.08	10.81		
Academic Engaged Time[b]	M	94.65	84.21	82.54	79.89	80.50	4.915	.001
	SD	6.24	8.94	10.48	24.95	11.24		
Task Management[b]	M	2.54	9.11	10.03	14.53	7.71	3.915	.005
	SD	2.01	6.96	7.93	20.45	1.18		
Inappropriate Behavior[b]	M	2.81	6.68	7.43	5.58	11.79	2.580	.040
	SD	4.81	7.05	6.38	5.06	11.40		

[a] F-ratios anad probability levels are based on df = 4,134.
[b] Composite variables that include several coded variables (see Table 3).

identified for the percentage of time students spent asking questions. A significantly lower percentage of time in attending was found for the 3:1 ratio (19%) than for STRs of 6:1 (38%), 9:1 (45%), and 12:1 (53%). Furthermore, a significant difference was found between STRs of 1:1 (28%) and 12:1 (53%) for percentage of time attending. The greater percentages of student response time in looking around was found in STRs of 6:1 (4%) and 12:1 (7%) compared to the STR of 1:1 (1%).

The follow-up test for the academic responding time (ART) composite indicated that the percentage of ART in STRs of 1:1 (66%) and 3:1 (55%) were significantly greater than the ART percentages in higher STRs (27% - 44%). For the academic engaged time (AET) composite, the greater percentage of time in the 1:1 ratio (95%) was found to be significantly different from AET percentages in the other four STR groups (80% - 84%). The follow-up test for the task management composite indicated that a significantly smaller percentage of time was spent in task management responses in the STR of 1:1 compared to 3:1, 6:1, and 9:1 (2% vs 8% - 14%). Finally, the follow-up test for the inappropriate behavior composite indicated a significant difference in percentage of time between STRs of 1:1 (3%) and 12:1 (12%).

Within-student analysis. Paired t tests were used to compare percentages of time for students in more than one STR; this was done for only the composite variables. First, paired t tests were run for subjects who participated in STRs of both 1:1 and 3:1 (see Table 6). A total of seven subjects was identified. Total academic time and the proportion of that time in the four composite variables (academic responding time, academic engaged time, task management, and inappropriate behavior) were found not to be significantly different for the 1:1 and 3:1 ratios.

Table 6

Comparison of Student-Teacher Ratios 1:1 and 3:1 for Percentage of Time in Composite Student Responses for Same Subject (n=7)

		Ratio			
		1:1	3:1	t-value	Prob[a]
Total Academic Time	M[b]	10.29	19.29	-2.07	ns
	SD	4.95	9.55		
Academic Responding Time	M	61.28	62.91	- .18	ns
	SD	17.10	20.10		
Academic Engaged Time	M	92.14	90.17	.54	ns
	SD	11.70	8.70		
Task Management	M	36.14	33.29	.30	ns
	SD	16.10	20.30		
Inappropriate Behavior	M	2.57	3.81	-1.27	ns
	SD	5.40	6.80		

[a]Two tailed t-values and probabilities are based on df = 6.
[b]Total academic time is recorded in actual minutes.

A similar paired t test procedure was conducted for subjects who participated in STRs of both 3:1 and 6:1 (n = 18). The data for this analysis are presented in Table 7. Again, significant differences were not found between the two ratios in this within-subject comparison.

Task Completion and Task Success

Independent group one-way ANOVAs were conducted to compare the percentages of task completion and task success for the five student-teacher ratios. The means and standard deviations, along with their calculated F-ratios and F-probabilities are shown in Table 8. All percentages were very high, with averages ranging from 89% to 100% for task completion, and from 83% to 94% for task success. No significant differences were found for these two variables. Correlations between each of three composite student response measures (ART, AET, inappropriate behavior) and both task completion and task success essentially were zero (.04 - .12).

Qualitative Nature of Instruction

Average ratings on six IES clusters for only those subjects observed in a single STR are shown in Table 9. The single STR criterion was applied because IES ratings for an individual subject were not separated if the student was in different student-teacher ratios. The numbers of such subjects were quite high. Ratings generally were around 3 ("like the student's instruction"). Average ratings are shown graphically Figure 1.

Kruskal-Wallis one-way ANOVAs were used to compare average ratings across ratios for each cluster. Significant differences were found for three of the

Table 7

Comparison of Student-Teacher Ratios 3:1 and 6:1 for Percentage of Time in Composite Student Responses for Same Subject (n=18).

		Ratio			
		3:1	6:1	t-value	Prob[a]
Total Academic Time	M[b]	16.44	24.64	-1.61	ns
	SD	11.10	13.74		
Academic Responding Time	M	48.64	46.50	.39	ns
	SD	20.10	16.50		
Academc Engaged Time	M	84.15	85.05	- .33	ns
	SD	9.60	11.30		
Task Management	M	10.80	8.99	.74	ns
	SD	6.60	9.30		
Inappropriate Behavior	M	5.05	5.96	- .54	ns
	SD	8.40	5.80		

[a]Two tailed t-values and probabilities are based on df = 6.
[b]Total academic time is recorded in actual minutes.

Table 8

Comparison of Task Completion and Task Success

		Ratio						
		1:1	3:1	6:1	9:1	12:1	F-Ratio	F-Prob[a]
Task Completion	M	99.92	95.95	91.04	88.88	95.13	1.537	ns
	SD	.33	11.11	18.69	27.23	8.08		
Task Success	M	87.96	90.33	87.05	94.05	82.82	.5537	ns
	SD	24.77	12.91	19.37	7.42	17.12		

[a]F-ratios and probability levels are based on df = 4,120.

Table 9

Comparison of Student-Teacher Ratios for IES Cluster Variables

		Ratio						
		1:1	3:1	6:1	9:1	12:1	Chi-square	Sig[a]
Instructional Presentation (N=107)	M	3.07	2.94	2.74	2.88	2.98	5.94	ns
	SD	.53	.51	.52	.52	.65		
Instructional Planning (N=106)	M	3.64	3.51	3.38	3.52	3.24	8.52	ns
	SD	.56	.48	.47	.30	.26		
Checking for Student Understanding (N=105)	M	3.47	3.19	2.77	2.95	2.70	20.74	.0004
	SD	.41	.50	.57	.72	.44		
Task Relevance (N=106)	M	3.59	3.43	3.08	3.10	3.23	20.46	.0004
	SD	.44	.39	.41	.86	.40		
Practice (N=106)	M	2.73	2.75	2.50	2.80	2.45	5.72	ns
	SD	.44	.53	.54	.48	.45		
Feedback (N=107)	M	3.56	3.36	2.94	3.12	3.24	15.05	.0046
	SD	.37	.60	.66	.33	.46		

[a]Chi-square and probability levels are based on df = n-1.

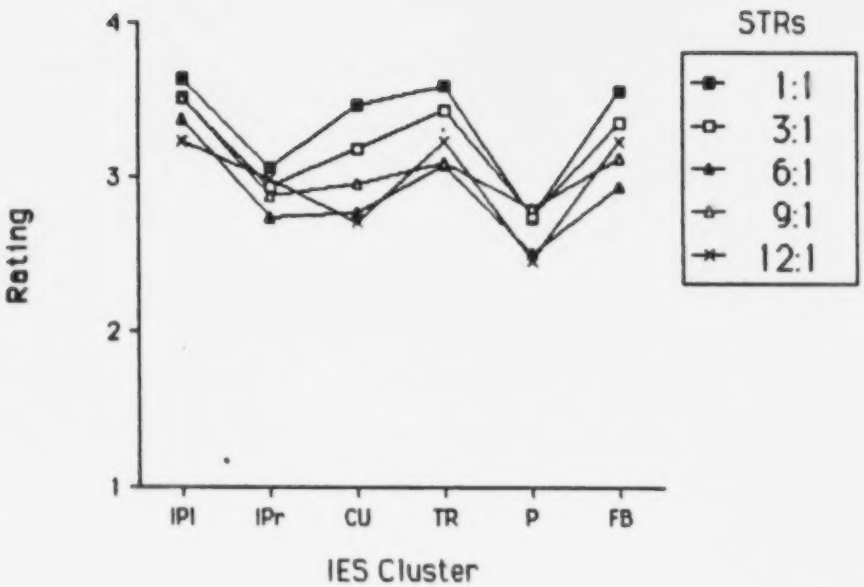

Figure 1. IES Ratings on Six Clusters for Different Student-Teacher Ratios

IES clusters ($p < .05$) (Checking for Student Understanding, Task Relevance, and Feedback). Ratings of Checking for Student Understanding were significantly higher for 1:1 and 3:1 than for 6:1, 9:1 and 12:1. On Task Relevance, the trend was toward higher mean ratings in 1:1 and 3:1 compared to 6:1 9:1 and 12:1. The feedback cluster ratings were higher for STRs of 1:1, 3:1, 9:1, and 12:1 than for 6:1.

The means and standard deviations are reported for all TIES domains in Table 10. Average ratings generally were about 3, indicating "like the student's instruction." Only for the Cognitive Emphasis domain were ratings notably lower. A graphic representation of these data are shown in Figure 2.

Comparisons of student-teacher ratios on the 12 TIES variable domains also were conducted using Kruskal-Wallis one-way ANOVAs, with a required probability level of .05. Significant differences between STR groups were found for only one component (Adaptive Instruction). The trend here was toward higher ratings for the 1:1 and 3:1 ratios compared to the 6:1, 9:1, and 12:1 ratios.

Discussion

Speculations that lower student-teacher ratios in special education classrooms are an important component of the "specialness" of special education is supported to some extent by the findings of the current study. Between-group comparisons of different ratios reached statistical significance on measures of both quantitative and qualitative aspects of instruction. Differences were noted in the percentages of time devoted to certain tasks (teacher tasks, teacher-student discussion) and physical structures (entire group, individual). More important, differences were found in the percentages of time in which

Table 10

Comparison of Student-Teacher Ratios for TIES Variable Domains

		1:1	3:1	6:1	9:1	12:1	Chi-square	Sig[a]
Instructional Presentation (n=107)	M	3.31	3.30	3.03	3.00	3.20	2.70	ns
	SD	.79	.73	.82	1.00	.45		
Classroom Environment (n=107)	M	3.44	3.54	3.29	3.60	3.20	3.17	ns
	SD	.89	.66	.71	.54	.84		
Teacher Expectations (n=107)	M	3.56	3.50	3.31	3.60	3.20	2.68	ns
	SD	.73	.72	.80	.54	.45		
Cognitive Emphasis (n=106)	M	2.56	1.93	2.06	2.20	2.20	5.25	ns
	SD	.89	.79	.90	.83	1.10		
Motivational Strategies (n=106)	M	3.00	3.20	2.74	3.00	3.25	5.06	ns
	SD	.82	.77	.85	.70	.50		
Relevant Practice (n=107)	M	3.38	3.46	3.20	3.20	3.20	3.04	ns
	SD	.62	.62	.68	.45	.84		
Academic Engaged Time (n=107)	M	3.69	3.72	3.34	3.20	3.40	8.21	ns
	SD	.60	.54	.72	.44	.55		
Informed Feedback (n=107)	M	3.56	3.59	3.20	3.20	3.60	6.48	ns
	SD	.63	.62	.76	.44	.55		
Adaptive Instruction (n=106)	M	3.62	3.43	2.82	3.00	2.40	22.60	.0002
	SD	.50	.69	.67	.70	.55		
Progress Evaluation (n=107)	M	3.50	3.41	3.22	3.40	3.00	2.46	ns
	SD	.63	.72	.84	.54	.71		
Instructional Planning (n=107)	M	3.56	3.39	3.06	3.00	3.00	8.95	ns
	SD	.73	.68	.76	0	0		
Student Understanding (n=107)	M	3.50	3.39	3.14	3.40	3.20	5.03	ns
	SD	.63	.65	.65	1.34	.45		

[a]Chi-square and probability levels based on (N-1) degress of freedom.

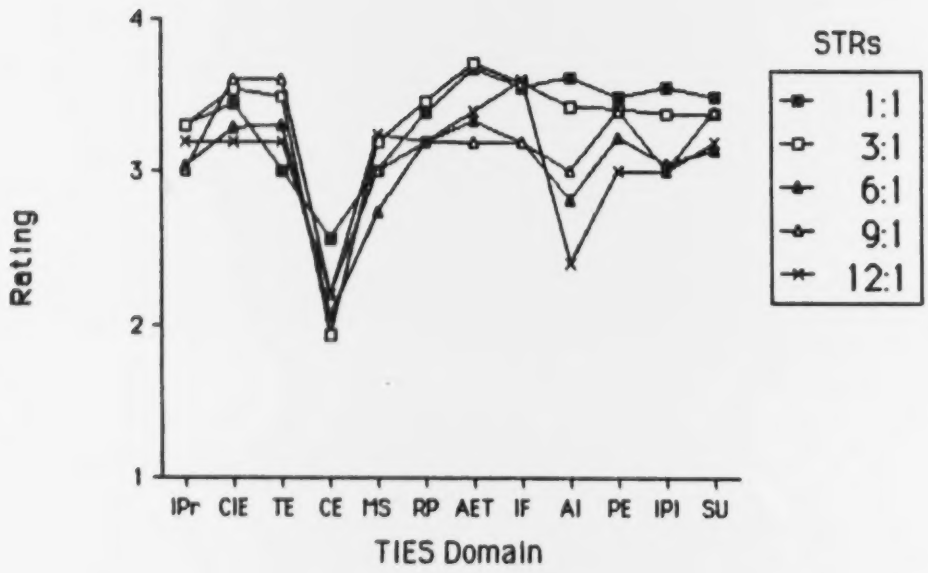

Figure 2. TIES Ratings on 12 Domains for Different Student-Teacher Ratios

students were making responses that were active academic responses, academic engaged time responses, task management responses, and inappropriate behaviors, as well as in the specific responses of writing, reading aloud, talking appropriately, answering questions, asking questions, attending, and looking around. Qualitatively, differences were found in the extent to which the student's instructional environment was characterized by checking for student understanding, task relevance, feedback, and adaptive instruction. The general direction of these findings are provided in summary format in Table 11. On seven variables, the higher ratio groups were higher than the lower groups. These variables include tasks and structures (more student-teacher discussion, teacher tasks, and entire group structures in higher ratios), as well as management responses and inappropriate responses, which are relatively more frequent in the higher ratios. All instances in which the lower ratios have higher values are for active student responses and characteristics considered to reflect effective instructional environments, both of which are considered critical to student learning (Anderson, 1984; Good & Brophy, 1984; Greenwood, Delquadri, & Hall, 1984).

Differences, however, were not found in measures of task completion and task success. The failure to find differences here obviously is related to the very high completion and success rates for all students in all student-teacher ratio groupings. The high rates very likely are related to the content of the tasks that students are asked to complete during their special education time.

All differences that were noted in the quantitative and qualitative measures of instruction were found in the between-group comparisons. Within-subject comparisons could only be conducted between "similar" ratios (1:1 and 3:1, 3:1 and 6:1) because these were the only combinations in which enough

Table 11

Direction of Significant Findings in Comparisons of Student-Teacher Ratios

Variable	Direction[a]
Teacher-Student Discussion	H > L
Teacher Tasks	H > L[b]
Entire Group	H > L[b]
Individual	L > H[b]
Writing	L > H
Read Aloud	L > H[b]
Talk Appropriate	L > H[b]
Answer Questions	L > H[b]
Ask Questions	?
Attending	H > L[b]
Looking Around	H > L[b]
ART	L > H[b]
AET	L > H[b]
Task Management	H > L[b]
Inappropriate Behavior	H > L[b]
Checking for Student Understanding	L > H
Task Relevance	L > H
Feedback	?
Adaptive Instruction	L > H

[a] "Direction of Findings" is indicated by H = higher ratios and L = lower ratios, without specification of ratios in H or L. A ? in this column indicates that H and L, in the same direction, were different from a ratio in the middle.

[b] These directional differences are supported by statistical follow-up tests; others are trends noted when statistical procedures could not be applied to follow-up a significant overall test.

subjects could be identified who participated in both. Of more interest to us here would be comparisons for students when they were in 1:1 versus when they were in 9:1, for example. Only a couple subjects were observed in this kind of combination. Case study analyses of these students are relevant (see Ysseldyke, Thurlow, Shriner, & Propsom, 1988), for they indicate that active responding time varies not only as a function of student-teacher ratios, but also as a result of various characteristics of the student, the home environment, and the community environment.

The finding that academic responding time accounted for a slightly greater percentage of students' time in STRs of 1:1 and 3:1 than in STRs of 6:1, 9:1 and 12:1 suggests, perhaps, a higher level of interaction between the student and the teacher. Whether there are true academic gains correlated to increased percentages of academic responding time or academic engaged time as measured by students' rate of task success and task completion could not be found with the results of this study. These findings suggest a focus for further research: If STRs have an impact on student academic response and academic engaged time, then what is the optimal STR for student academic gain? This study indicates that it may be the 1:1 situation.

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